

TABLE 4.—Mean altitudes and temperatures of significant points identifiable as tropopause during January 1940, classified according to the potential temperatures (10-degree intervals between 290° and 409° A.) with which they are identified. (Based on radiosonde observations)—Con.

Potential temperatures	Medford, Oreg.			Miami, Fla.			Minneapolis, Minn.			Nashville, Tenn.			Oakland, Calif.			Oklahoma City, Okla.			Omaha, Nebr.		
	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.
290-299	2	6.2	-47.0				12	6.8	-46.3	1	5.2	-26.0				2	5.4	-35.5	3	6.4	-40.3
300-309	1	9.0	-55.0				21	8.2	-52.2	3	6.6	-34.4				3	6.6	-38.4	18	7.7	-45.1
310-319	13	9.7	-55.3				17	9.7	-59.5	16	9.6	-48.5				13	9.7	-55.3	22	9.7	-57.5
320-329	18	11.1	-61.3				7	10.4	-60.1	15	10.2	-54.7				13	10.9	-59.8	16	10.4	-58.2
330-339	8	11.6	-62.0				2	11.4	-58.5	6	11.3	-59.2				14	11.7	-60.3	7	11.1	-59.3
340-349	2	12.2	-62.0	9	9.6	-43.0				2	11.7	-57.0				2	12.0	-56.0	4	11.9	-61.2
350-359				20	10.6	-47.0				3	12.4	-58.0				3	13.5	-66.0			
360-369				19	12.7	-61.8															
370-379	1	12.9	-46.0	7	13.8	-65.9	1	11.0	-52.0												
380-389	1	14.2	-65.0	11	14.5	-67.1	1	12.6	-56.0												
390-399				5	15.4	-72.4	1	12.6	-53.0	1	13.2	-56.0							2	13.4	-58.5
400-409				8	16.3	-74.2				1	14.7	-63.0							1	15.0	-63.0
Weighted means	2	15.5	-61.5	7	16.8	-73.4													1	14.4	-58.0
Mean potential temperature (weighted)	1	16.0	-64.0	6	17.6	-76.2	1	15.5	-58.0	1	15.8	-61.0							1	16.0	-61.0
	11.0	-59.1		13.3	-61.2		9.0	-54.3		9.7	-50.2		11.6	-58.6		9.8	-54.9		9.8	-54.5	
	329.4			356.5			312.6			324.6			338.0			318.6			321.7		

Potential temperatures	Phoenix, Ariz.			St. Louis, Mo.			San Antonio, Tex.			Sault Ste. Marie, Mich.			Spokane, Wash.			Washington, D. C.		
	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.
290-299	1	5.1	-28.0	8	6.3	-41.0				22	6.9	-49.6	12	6.6	-42.9	6	6.6	-43.0
300-309	1	7.2	-41.0	15	7.5	-45.8				23	8.4	-55.0	4	8.6	-54.0	15	7.7	-46.2
310-319	11	9.3	-50.5	29	9.6	-55.3	8	9.0	-47.1	17	9.7	-60.5	23	9.4	-54.6	13	9.0	-51.6
320-329	18	10.9	-59.3	11	10.5	-59.3	15	10.2	-52.1	4	10.0	-57.2	23	10.7	-60.8	6	10.4	-57.0
330-339	15	11.6	-60.4	7	11.1	-59.1	23	11.7	-58.7				9	11.8	-63.8	2	10.6	-51.5
340-349	1	13.6	-70.0	3	11.1	-53.3	7	12.5	-61.0				2	12.4	-62.0			
350-359	1	14.2	-71.0	1	12.6	-61.0	4	13.1	-61.5									
360-369	2	14.2	-63.5	2	12.6	-58.0	6	14.0	-65.5									
370-379				4	13.4	-57.5	3	15.1	-69.7									
380-389	1	16.0	-71.0	3	13.9	-58.0	4	15.7	-68.8									
390-399	2	16.4	-70.0				3	15.9	-65.7									
400-409	3	16.1	-66.8	1	16.7	-64.0	3	16.6	-68.7				2	16.4	-60.5			
Weighted means	11.4	-58.4		9.6	-53.1		12.1	-58.7		8.3	-54.5		10.0	-56.1		8.4	-49.2	
Mean potential temperature (weighted)	334.7			322.1			243.8			304.5			319.5			311.8		

RIVERS AND FLOODS

(River and Flood Division, MERRILL BERNARD, in charge)

By BENNETT SWENSON

Precipitation during December 1939 was generally below normal over the country except in the far Northwest. River stages were low throughout the month with only a few exceptions, due to the continued deficiency of precipitation extending from summer and fall months.

In the Columbia Basin a minor rise occurred on December 15 and 16 but no appreciable flooding resulted. The Trinity River at Liberty, Tex., reached 24.3 feet (flood stage 24 feet) on the 27th but no material damage was reported.

During the 3 days, December 8, 9, and 10, the total precipitation at Eureka, Calif., amounted to 7.25 inches, and proportional amounts of precipitation were reported over the Eel River Basin. Only once in 52 years, February 2-4, 1890, has an equal amount of rain occurred during the same period of time at Eureka and then there was a

total of 8.28 inches. Although this was one of the greatest rains of record in that basin no flood stages were reached. This was due generally to the extremely depleted state of the ground water, the early slackening of the rain in the important Willits drainage area, the pause between intervals of intense precipitation, and the total absence of a snow cover. Some of the creeks in the vicinity of Eureka overflowed their banks on December 10 when 3.37 inches of rain fell within 9 hours.

The month of January 1940 was characterized by extremely low temperatures through the Central and Southern States east of the Rocky Mountains. On the other hand, the States west of the Rocky Mountains had above normal temperatures. Precipitation was deficient in much of the Mississippi drainage and eastward, except in Kansas and the Southeast, and in the Southwest, while

it was abnormally heavy in the Rocky Mountain area and in most of California. Other sections had generally normal or near normal amounts. Snowfall was unusually heavy from the Potomac Valley southward into Virginia and North Carolina.

Near the end of the month the snow cover in the eastern half of the country extended as far south as central or southern Georgia, Alabama, and Mississippi. The cover was fairly heavy in portions of the upper Mississippi and Ohio River Basins, the Potomac and James River Basins and in northern New England. In the far West, mountain snowfall was still deficient in much of Arizona, New Mexico, Nevada, and portions of Montana and Washington.

Ice in the rivers was heavy in most northern and eastern districts with ice covering most of the Ohio River and floating ice persisted in the Mississippi south of Helena, Ark. It was reported that the Cumberland River was entirely frozen over at Nashville, Tenn. The Delaware and Susquehanna Rivers were frozen over the entire month with the ice varying in thickness from 10 to more than 20 inches near the end of the month. At Washington, D. C., above Key Bridge, the ice in the Potomac River measured 12 to 15 inches. Some gorging of ice occurred, principally in the Ohio River, but did not reach any serious proportions. The main difficulty was from hindrance to navigation.

Minor rises occurred in a few rivers during the month but flood stage was reached, or exceeded, only at Clio, Ga., on the Savannah River, crest 12.2 feet on the 26th; at Blountstown, Fla., on the Apalachicola River, crest 15 feet on the 18th; and at Lock No. 3 on the Tombigbee River, crest 34.5 feet on the 17th. No damage was reported.

Heavy precipitation occurred over the Sacramento Basin, during the month, in contrast to the scanty rainfall over this area during the preceding months of this season. The total monthly rainfall for Sacramento,

Calif., was 7.98 inches, the highest of record for any January since 1916. There was a heavy overflow into all bypasses, although flood stage was not reached at any of the reporting stations. The only known damage was from the flooding of about 2,700 acres in the Yolo Bypass, on the 12th, where a total loss of about \$57,500, mostly of grain land, was reported.

Abnormally low stages prevailed at a few points, principally in the Mississippi River. The river stage at St. Louis, Mo., on January 16, -6.1 feet, is the absolute lowest stage of record (1861-Jan. 31, 1940); the previous lowest stage was -5.5 feet on December 12 and 13, 1937. The low stage this year was not directly due to an ice gorge (unlike the low stage in December 1937) but to the low volume of water and was only indirectly affected by ice conditions above.

Table of flood stages during December 1939 and January 1940

River and station	Flood stage	Above flood stages— dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE	<i>Feet</i>			<i>Feet</i>	
Savannah: Clio, Ga.-----	11	Jan. 23	Jan. 28	12.2	Jan. 26
EAST GULF OF MEXICO DRAINAGE					
Apalachicola: Blountstown, Fla.-----	15	Jan. 18	Jan. 18	15.0	Jan. 18
Tombigbee: Lock 3 (Whitfield, Ala.)----	33	Jan. 15	Jan. 18	34.5	Jan. 17
WEST GULF OF MEXICO DRAINAGE					
Trinity: Liberty, Tex.-----	24	Dec. 26	Dec. 27	24.3	Dec. 27
PACIFIC SLOPE DRAINAGE					
<i>Columbia Basin</i>					
South Yamhill: Willamina, Oreg.-----	8	Dec. 15	(1)	9.6	Dec. 16

¹ No record.

WEATHER ON THE ATLANTIC AND PACIFIC OCEANS

[The Marine Division, I. R. TANNEHILL, in charge]

NORTH ATLANTIC OCEAN, JANUARY 1940

By H. C. HUNTER

Atmospheric pressure.—The average pressures were considerably lower than normal from the waters adjoining eastern Canada and the northeastern United States east-southeastward to southwestern Europe and adjacent Africa. The deficiency at Horta, in the Azores, was 7.9 millibars. Near southern Greenland, however, there was a marked excess, and over the northern Gulf of Mexico a moderate excess. The first 10 days over middle and higher latitudes brought lower pressures on the average than the remainder of the month.

The extremes of pressure in available vessel reports were 1,035.6 and 962.2 millibars (30.58 and 28.41 inches). The higher reading was noted on the American steamship *Cities Service Boston* during the forenoon of the 7th near the Chesapeake Capes. On land the New Orleans station noted a like reading on the 25th, and the Julianehaab station an even higher one on the 15th and 16th. The low mark was read on the Danish steamship *Svanhild*, near 45° N., 47° W.; the day was the 7th, as with the high mark, while the hour was noon. Table 1 shows that a slightly lower reading was made at Belle Isle, near northern Newfoundland, on the 4th.

TABLE 1.—Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, January 1940

Station	Average pressure	Departure	Highest	Date	Lowest	Date
	Millibars	Millibars	Millibars		Millibars	
Julianehaab, Greenland ¹	1,005.6	+9.0	1,041	15, 16	971	6
Lisbon, Portugal.	1,016.1	-4.9	1,026	26, 27	999	2
Horta, Azores.	1,013.4	-7.9	1,029	20	993	1
Belle Isle, Newfoundland ² ..	1,001.1	-6.0	1,039	14	960	4
Halifax, Nova Scotia.	1,011.8	-3.4	1,033	14	990	2
Nantucket.	1,013.9	-3.4	1,033	10	999	15
Hatteras.	1,018.0	-2.7	1,032	10	989	24
Turks Island.	1,016.5	-1.1	1,019	7-9, 11, 28	1,012	10, 29
Key West.	1,019.0	-0.3	1,030	28	1,012	23
New Orleans.	1,022.7	+2.4	1,036	25	1,005	14

¹ For 24 days.

² For 26 days.

NOTE.—All data based on a. m. observations only, with departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

Cyclones and gales.—So far as reports show, the month was somewhat less stormy over the North Atlantic than the average January, but it was considerably stormier than the preceding December.

Three lows are particularly noteworthy. The earliest was over the central Lake region on the morning of the 5th, with an accompanying secondary over the north-